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The Evolution of Concentration**

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Acquisitions versus Entry: The Evolution of Concentration

Zava Aydemir and Armin Schmutzler*

Abstract: We consider market dynamics in a reduced form model. In the simplest version, there are two investors and several small non-investing firms. In each period, one investor can acquire a small firm, the other investor decides about market entry. After that *all* firms play an oligopoly game. We derive conditions under which increasing market concentration arises with myopic firms, we show that a model with forward-looking firms and with arbitrary numbers of investors yield similar results. We apply the framework to a Cournot model with cost synergies and a Bertrand model where acquisitions extend the product spectrum of a firm.

Keywords: Acquisitions, Entry, Concentration, Synergies, Product Variety.

JEL: D43, L11, L12, L13

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1 Introduction

This paper analyzes the circumstances under which acquisition as a force towards concentration dominates over entry as a countervailing force.¹ Categorizing possible market dynamics in the broadest possible way, the following four types of stylized patterns are conceivable: (1) acquisitions without entry, (2) entry without acquisitions, (3) acquisitions with simultaneous entry, (4) neither acquisitions nor entry. If one is willing to abstract from details, all four examples arise in the real world.

- (1) The British beer industry underwent a period of concentration in the nineteen fifties and sixties (Sutton 1991). Large brewers acquired small ones to gain access to their retail outlets, i.e. pubs. At the same time, there was very little entry.
- (2) The personal computer industry in the early 1980s provides the opposite example of a market with massive entry, but virtually no acquisitions, resulting in a growth of firm numbers from 8 in 1980 to 51 in 1986 (see Stavins, 1995).
- (3) The European airline market exhibits simultaneous acquisitions and entry: Following European deregulation in 1997, national flag carriers took over small regional airlines while, at the same time, low fare start-ups found their niches by supplying products differentiated from the supply of the big airliners². Also, Pesendorfer (2002) describes how new firms regularly enter the software industry and the toy industry, but are acquired soon afterwards.
- (4) Finally, in the market for corporate law in the United States, neither entry nor acquisitions played an important role, resulting in a largely

¹We fully acknowledge that by restricting ourselves to acquisitions and entry we ignore internal investment and exit as important forces of structural change.

²See The Economist (1997) and (2001).

stable market structure. Despite dramatic changes in the legal market (a proliferation of regulations and law suits) the same law firms as in 1985 still dominate the legal market for corporate law and litigation.³

We analyze which circumstances generate dynamics of type (1) - (4), respectively. In our model, large firms can acquire small firms, and there is potential entry. Both activities are costly. We then ask under which circumstances it is more likely for large firms to bear the costs of acquisition than it is for small firms to enter.

In each period, an "investment stage" is followed by (reduced form) product market competition. All but two firms play a passive role in the investment stage – by assumption, they cannot invest. These passive firms are called *small incumbents*. Of the remaining two firms, one is a *potential entrant* whose investment is market entry. A firm that enters will not be distinguishable from a small incumbent thereafter. The other remaining firm is called a *large incumbent*. It is best to think of the large firm as being the result of sequential acquisitions of small (unit size) firms – its size then describes how many constituent small firms it consists of. By assumption, only the large firm is allowed to acquire others. Acquiring competitors has two potential benefits. First, the reduction in the number of competitors increases equilibrium profits. Second, there may be advantages to being large – for instance, due to economies of scale or scope. The extent to which such synergies arise is a parameter of the model – in principle there may even be negative synergies.

Thus, the investment stage is a two-player game between the large incumbent and the potential entrant where each firm can choose between two actions – "investment" (acquisition/entry) or "non-investment". Some complexity arises, however, because acquisition costs themselves should depend on market structure.⁴

We give a complete description of the equilibrium structure for the static model, where only one period is considered. In particular, we identify the

³See The Economist (2000).

⁴They are most reasonably interpreted as a compensation to the owners of the acquired firm for not earning product market profit.

circumstances under which a *strong concentration equilibrium* arises in which there is acquisition, but no entry. Most importantly, a stronger positive impact of an increase in own size on the large incumbent's profits, a stronger positive profit effect of a reduction in the number of competitors, and greater intensity of competition, defined as low profit levels of small firms, make such equilibria more likely.

The results from the static model provide useful inputs for dynamic considerations. First, we allow firms to make repeated myopic investments and give conditions for self-reinforcing concentration. Second, we show that the comparative statics for the myopic model essentially carry over to a two-period model with forward-looking firms.

We apply our framework to two examples: a linear Cournot model where acquisitions involve synergies from cost reductions and a model of differentiated price competition where an acquisition expands the product spectrum of the large firm. The dynamics of these models reveal interesting differences. In the synergy model, initial conditions (number of small firms, size of large firm) strongly influence the long-term behavior of the system: Monopolization only arises if the initial number of firms is already sufficiently small, and/or the large firm is sufficiently small. In the variety model, concentration increases for arbitrary initial values.

We extend our two-player static game to a setting in which several incumbents are able to acquire and several firms may enter the market. We then give sufficient conditions for large firms to invest at least as much as small firms. Self-reinforcing concentration arises under conditions quite similar to the myopic two-player market dynamics model, even though additional countervailing forces arise.

The paper relates to several strands of literature. Several authors consider endogenous changes in market dominance for given firm numbers. They describe circumstances under which firms that are ahead of others in terms of some state variable can increase their lead over time.⁵ This literature suffers from the obvious drawback that it does not deal with mergers or market

⁵Variants of these approaches include incremental investment games (Flaherty 1980), learning-by-doing models (Cabral and Riordan 1994) or switching cost models (Beggs and Klemperer 1992); Athey and Schmutzler (2001) provide an integrated approach.

entry. Nevertheless, the conditions for increasing dominance in such models resemble our conditions for increasing concentration. Models of market dynamics allowing for changes in firm numbers include Ericson and Pakes (1995) and Gowrisankaran (1999). While the set-up of these papers is more general than ours, we add to them by relating explicit conditions for increasing concentration to the nature of the underlying oligopolistic competition. Pesendorfer (2002) is closely related in the sense that he also focuses on mergers and entry. However, he pursues a very different objective from ours: He demonstrates that in situations where mergers reduce short-term profits of the participants, strategic long-term considerations can make them profitable. Issues of firm heterogeneity and entry incentives that are central to our paper are not addressed.⁶

The paper is organized as follows. Section 2 introduces our model. In section 3, we characterize static equilibria. Section 4 contains dynamic considerations. Section 5 discusses examples. Section 6 sketches a generalization to more than two investing firms. Section 7 contains a discussion of our results and prospects for future research.

2 The Model

We consider a market over periods $t = 1, \dots, T \leq \infty$. In each period, *large incumbents*, *small incumbents* and *potential entrants* play an investment game, followed by product market competition; at the beginning of period t , the total number of firms is N^{t-1} . Each firm i 's size at the beginning of the investment stage of period t is summarized by a state variable $Y_i^{t-1} \in \mathbb{N}$. For incumbents, $Y_i^{t-1} > 0$. If $Y_i^{t-1} = 1$, an incumbent is called small, otherwise large. For entrants, $Y_i^{t-1} = 0$. The initial state $\mathbf{Y}^0 = (Y_1^0, \dots, Y_I^0)$ is exogenous.

Large firms can invest in every period. Their investment consists of acquiring a small firm. By assumption, an acquisition increases the state of the acquiring firm by 1 and reduces the state of the acquiree to 0. Also, by

⁶By concentrating on homogeneous firms and essentially making entry exogenous, Pesendorfer can analyze Markov-perfect equilibria. The price we pay for allowing heterogeneity and endogenizing entry is that our dynamic treatment is more rudimentary.

assumption small firms cannot invest. For entrants, investment means entering the market. For simplicity, we assume that an entrant can only enter as a small firm. Thus, given all initial states Y_i^{t-1} , firms simultaneously choose investment levels $a_i^t \in \{0, 1\}$, and the new state of the investing firms is $Y_i^t = Y_i^{t-1} + a_i^t$.

The relation between states and profits is summarized in the following assumptions.

- (A1) *For every vector $\mathbf{Y}^t = (Y_1^t, \dots, Y_{N^t}^t)$, there exists a unique profile of equilibrium payoffs $\Pi^i(\mathbf{Y}^t)$ for $i = 1, \dots, N^t$ in each period t .*
- (A2) *Profits are exchangeable: that is, first, for any firm i a permutation of the vector \mathbf{Y}_{-i}^t does not change the profits of firm i ,⁷ and second, if $i \neq j$ such that $Y_i^t = Y_j^t$ and \mathbf{Y}_{-i}^t is identical with \mathbf{Y}_{-j}^t up to a permutation then $\Pi^i(\mathbf{Y}^t) = \Pi^j(\mathbf{Y}^t)$.*
- (A3) *$\frac{\partial \Pi^i}{\partial Y_j^t} < 0$ for $j \neq i$: that is, other things being equal, profits are lower the higher the state of the competitor.*
- (A4) *$\Pi^i(\mathbf{Y}^t) = 0$ if $Y_i^t = 0$.*

Except for section 6, we consider the following special case:

- (A5) *In each period $t \geq 1$, there are only two firms that can invest: one large firm, namely $i = 1$, and one potential entrant, denoted as e_t .*

By (A2), the product market profit of each small firm is fully determined by the state of the large firm and the total number $F^t = F^{t-1} + a_{e_t}^t - a_1^t$ of small firms in the industry, and similarly for the large firm. Thus, we denote small firms' profits as $\Pi^S(Y_1^t, F^t)$ and large firms' profits as $\Pi^L(Y_1^t, F^t)$, respectively.⁸ Entry costs are exogenous, given as $E > 0$. Acquisition costs, however, are influenced by the outside options of small firms. Their owners will only agree to a takeover if the profits they could earn with a small firm

⁷As usual, \mathbf{Y}_{-i} stands for the vector of states of all firms except firm i .

⁸For instance, suppose, $Y_1^t = M \geq 2, Y_2^t = Y_3^t = Y_4^t = 1$. Then profits for firm 1 are $\Pi^L(M, 3) = \Pi^1(M, 1, 1, 1)$ and $\Pi^S(M, 3) = \Pi^i(M, 1, 1, 1)$ for firms $i = 2, 3, 4$.

in the market are not higher than what they get as a compensation for the takeover. By (A3), small firm profits are decreasing in the size of the large firm and the number of small competitors.⁹ Thus, the following assumption is natural.

(A6) *Acquisition costs are a function $AC(Y_1^t, F^t)$ that is decreasing in both variables.*

3 The Static Game

The payoffs of the one-period game are presented in Table 1.

< Table 1 about here >

The Nash-equilibria are straightforward to derive. All conceivable constellations of pure strategy equilibria arise for suitable parameters. We give explicit conditions for the *strong concentration equilibrium* $(a_1^t, a_{e_t}^t) = (1, 0)$

Proposition 1 (a) *Each of the following seven equilibrium constellations is possible for some set of parameters:*

(a1) *Unique equilibria $[(0, 0), (0, 1), (1, 0) \text{ or } (1, 1)]$.*

(a2) *Multiple pure strategy equilibria $[(0, 0) / (1, 1) \text{ or } (0, 1) / (1, 0)]$.*

(a3) *No pure strategy equilibria.*¹⁰

(b) *The strong concentration equilibrium $(1, 0)$ arises as a unique pure strategy equilibrium if the following conditions hold simultaneously.*¹¹

⁹Note, however, that $\partial \Pi^s / \partial Y_1^t < 0$ from assumption (A3) does not exclude the possibility of positive acquisition externalities on small firms' profits. Positive externalities might still arise even though there is a negative impact of a larger competitor on the small firm profit, because an acquisition simultaneously reduces the number of firms competing in the market, which increases profits of the remaining firms.

¹⁰A full description of the equilibrium structure, which we require in our later numerical examples, is available on request from the authors.

¹¹For existence, it suffices that conditions (ENT1) and (ACQ0) hold with weak inequality.

$$(i) \quad \Pi^S(Y_1^{t-1} + 1, F^{t-1}) < E. \quad (ENT1)$$

$$(ii) \quad \Pi^L(Y_1^{t-1} + 1, F^{t-1} - 1) - \Pi^L(Y_1^{t-1}, F^{t-1}) > AC(Y_1^{t-1} + 1, F^{t-1} - 1) \quad (ACQ0)$$

$$(iii) \quad \Pi^S(Y_1^{t-1} + 1, F^{t-1}) < E \text{ or} \quad (ENT0)$$

$$\Pi^L(Y_1^{t-1} + 1, F^{t-1}) - \Pi^L(Y_1^{t-1}, F^{t-1} + 1) > AC(Y_1^{t-1} + 1, F^{t-1}) \quad (ACQ1)$$

The proof involves straightforward checks of best response conditions. For instance, (ENT1) is the no-entry condition and (ACQ0) is the acquisition condition.¹² Together they guarantee existence. (ENT0) or (ACQ1) gives uniqueness.

To interpret proposition 1(b), define the net entry effect (*NEE*) on the entrant's profit as

$$NEE = \Pi^S(Y_1^{t-1} + 1, F^{t-1}) - E$$

and the net acquisition effect (*NAE*) on the incumbent's profit as

$$NAE = \Pi^L(Y_1^{t-1} + 1, F^{t-1} - 1) - \Pi^L(Y_1^{t-1}, F^{t-1}) - AC(Y_1^{t-1} + 1, F^{t-1} - 1).$$

The strong concentration equilibrium exists when $NAE \geq 0 \geq NEE$. Thus, a necessary condition for the strong concentration equilibrium is that the net investment effect *NIE* on profits is at least as large for acquisitions than for entry. Clearly,

$$\begin{aligned} OSE &= \Pi^L(Y_1^{t-1} + 1, F^{t-1} - 1) - \Pi^L(Y_1^{t-1}, F^{t-1} - 1) \\ MSE &= \Pi^L(Y_1^{t-1}, F^{t-1} - 1) - \Pi^L(Y_1^{t-1}, F^{t-1}). \end{aligned}$$

OSE is the *own state effect*, describing how the higher own state after an acquisition translates into (usually) higher profits. *MSE* is the *market struc-*

¹²The numerical symbol in the conditions denotes the opponent player's action. For instance, (ENT1) says that entry is not profitable for the entrant, given that the large firms plays $a_1^t = 1$.

ture effect, which isolates the profit increase resulting from the elimination of one competitor. Then, we have

$$NAE = OSE + MSE - AC(Y_1^{t-1} + 1, F^{t-1} - 1).$$

Thus, if profit reacts strongly to an increase in the own state, $(ACQ0)$ and $(ACQ1)$ are more easily fulfilled, as OSE tends to be large. Further, if the adverse effect of an additional competitor on one's own profit is higher, the acquisition condition is also more easily fulfilled, as MSE is larger. Finally, if small firms earn lower profits, conditions $(ENT0)$ and $(ENT1)$ are more easily met. The last case, lower small firm profits, can be regarded as an instance of more intense competition.¹³ Thus, more intense competition may help foster concentration.¹⁴

4 Beyond the Static Game

We now move towards dynamic considerations. First, we ask under which conditions concentration trends are self-reinforcing for myopic firms. Then, we deal with forward-looking firms in a two-period version of the game.

4.1 The Repeated Myopic Game

Suppose firms make myopic investment choices in each period, taking only those effects on product market competition into account that arise in the immediately following period. Under which circumstances will a strong concentration equilibrium in period 1 make the conditions for such an equilibrium easier to fulfill in period 2, that is, under which conditions is concentration self-reinforcing? The following terminology is useful.

¹³For a related discussion of the notion "increasing competition", see Boone (2001).

¹⁴Note, however, that this statement is of a ceteris-paribus type. In models of homogeneous good price competition with Y_1 corresponding to (the negative of) marginal costs, there will be no incentive for acquisitions *if the large firm already has sufficiently low costs*: Even though small firm profits (and thus acquisition costs) are zero, the same is true for OSE and MSE .

- Definition 1** (1) *There are positive (negative) acquisition externalities at (Y_1^{t-1}, F^{t-1}) if $\Pi^S(Y_1^{t-1} + 1, F^{t-1} - 1) > (<) \Pi^S(Y_1^{t-1}, F^{t-1})$.*
- (2) *There are increasing (decreasing) acquisition costs at (Y_1^{t-1}, F^{t-1}) if $AC(Y_1^{t-1} + 1, F^{t-1} - 1) > (<) AC(Y_1^{t-1}, F^{t-1})$.*
- (3) *Acquisition incentives are self-reinforcing (self-reducing) at (Y_1^{t-1}, F^{t-1}) if $\Pi^L(Y_1^{t-1} + 1, F^{t-1} - 1) - \Pi^L(Y_1^{t-1}, F^{t-1}) > (<) \Pi^L(Y_1^{t-1}, F^{t-1}) - \Pi^L(Y_1^{t-1} - 1, F^{t-1} + 1)$.*

Acquisition externalities are thus positive if the benefits for a small firm from the elimination of one small competitor outweigh the losses from facing a larger competitor. As acquisition costs depend on small firm profits, positive acquisition externalities and increasing acquisition costs are closely related. Acquisition incentives are self-reinforcing if an acquisition makes a future acquisition more valuable. The following conditions help to detect whether acquisition incentives are self-reinforcing or -reducing.¹⁵

Lemma 1 *Acquisition incentives are self-reinforcing if $\Pi_{Y_1 Y_1}^L \geq 0, \Pi_{Y_1 F}^L \leq 0$ and $\Pi_{FF}^L \geq 0$ and self-reducing if $\Pi_{Y_1 Y_1}^L \leq 0, \Pi_{Y_1 F}^L \geq 0$ and $\Pi_{FF}^L \leq 0$.*

Proof. Appendix A ■

To understand the conditions in lemma 1, represent product market profits $\Pi^L(Y_1, F)$ as the product of equilibrium demand for the large firm, $D^L(Y_1, F)$ and the price-unit cost difference (mark-up) $M^L(Y_1, F)$ so that $\Pi^L(Y_1, F) = D^L(Y_1, F) \cdot M^L(Y_1, F)$. Clearly, $\Pi_{FF}^L = 2D_F^L \cdot M_F^L + D_{FF}^L \cdot M^L + D^L \cdot M_{FF}^L$. Under the natural assumption that $D_F^L < 0$ and $M_F^L < 0$, the first term on the right-hand side is positive, reflecting a complementarity between demand and mark-up (a higher mark-up is more valuable for higher demand). The remaining terms might be negative, but in many cases the complementarity dominates, so that $\Pi_{FF}^L \geq 0$. Similar arguments apply to the conditions $\Pi_{Y_1 Y_1}^L \geq 0$ and $\Pi_{Y_1 F}^L \leq 0$.

We now give conditions under which monopolization arises for arbitrary initial values.

¹⁵As usual subscripts stand for partial derivatives.

Proposition 2 *Suppose there are negative acquisition externalities, decreasing acquisition costs and self-reinforcing acquisition incentives for some Y_1^0 , F_1^0 . Then if the myopic game has a strong concentration equilibrium in period 1, this will also be true in all future periods until monopolization arises.*

Proof. Appendix B ■

The conditions in proposition 2 rarely hold for arbitrary initial values. Specifically, many oligopoly models display positive acquisition externalities and thus increasing acquisition costs: This is a source of limits to concentration.

4.2 Forward-Looking Firms

As a full analysis of forward-looking firms is rather tedious, we restrict ourselves to two-period games. We show how the existence of a strong concentration equilibrium in the repeated myopic game relates to the existence of a subgame perfect equilibrium with increasing concentration in the two-period version of the game.

We distinguish between first- and second-period acquisition costs. Acquisition costs in the second period are the same as in the myopic, one-period game. Acquisition costs in period 1 should be higher, as a firm that is acquired foregoes profits for two periods. In addition, they should differ according to whether entry takes place in period 1 or not, just as the corresponding small firm profits do. In the former case we write AC_1 , otherwise AC_0 , in both cases we speak of *long-term acquisition costs*.

Proposition 3 *Suppose parameters are such that every second-period subgame has a strong concentration equilibrium. Suppose that $\Pi^S(Y_1^0 + 1, F^0) + \Pi^S(Y_1^0 + 2, F^0 - 1) \leq E$ and $AC_0 \leq 2AC(Y_1^0 + 1, F^0 - 1)$. Then, concentration increases in both periods in any SPE.*

Proof. Appendix C ■

Intuitively, "no entry" requires that the expected profits over *both* periods are smaller than the entry costs, which corresponds to the first inequality. Compared to the myopic case, acquisitions today have the additional benefit

that they will allow a higher product market profit tomorrow. If, as required by the second inequality, long-term acquisition costs are not higher than short-term acquisition costs, the acquisition condition is thus easier to fulfill for a concentration equilibrium in period 1 with forward-looking firms. Thus, qualitatively, the conditions leading to increasing concentration in the myopic case are not misleading.

Note that the reinforcement of acquisition incentives discussed above is not the result of strategic effects, as for the parameters under consideration there is no second-period entry anyway. Strategic effects arise when acquisitions in period 1 influence entry incentives in period 2. The following terminology is helpful.

Definition 2

*An acquisition is **entry-deterring** if*

$$\Pi^S(Y_1^0 + 1, F^0 + a_{e_1}^1) > E > \Pi^S(Y_1^0 + 2, F^0 - 1 + a_{e_1}^1) \text{ for } a_{e_1}^1 \in \{0, 1\}.$$

*(2) An acquisition is **entry-triggering** if*

$$\Pi^S(Y_1^0 + 1, F^0 + a_{e_1}^1) < E < \Pi^S(Y_1^0 + 2, F^0 - 1 + a_{e_1}^1) \text{ for } a_{e_1}^1 \in \{0, 1\}.$$

Thus, if an acquisition is entry-deterring, entry becomes undesirable for the entrant in the following period when the large incumbent acquires a small firm in the preceding period of the game. An analogous interpretation applies for entry-triggering acquisitions.¹⁶ By (A3), entry always has a negative effect on the large incumbent's profits. Thus, the large firm will have a strategic incentive to avoid entry, as summarized in the next proposition.

Proposition 4 *Suppose acquisition is entry-deterring. Suppose that parameters are such that the large incumbent invests in every second-period subgame. Finally, assume that $a_{e_1}^1 = 0$. Then the strategic incentive to invest is $\Pi^S(Y_1^0 + 1, F^0 - 1) - \Pi^S(Y_1^0 + 1, F^0) + AC(Y_1^0 + 1, F^0) - AC(Y_1^0 + 1, F^0 - 1)$.*

Proof. Appendix D. ■

¹⁶Note that negative acquisition externalities are necessary for entry-deterring acquisitions and positive acquisition externalities are necessary for entry-triggering acquisitions.

The large incumbent therefore tends to "overinvest" in the case of entry deterring acquisitions. Similarly, it can be shown that he tends to "underinvest" in the case of entry triggering acquisitions.¹⁷

5 Examples

We now discuss the implications of Propositions 1 and 2 for two examples. First, we consider cost-reducing acquisitions in a linear Cournot example. Second, we consider "mergers for variety", where acquisition increases the product spectrum of a firm.

In both examples, we assume that acquisition costs amount to

$$AC(Y_1^{t-1} + 1, F^{t-1} - 1) = \min \{ \Pi^S(Y_1^{t-1}, F^{t-1}), \Pi^S(Y_1^{t-1} + 1, F^{t-1} - 1) \}. \quad (1)$$

We refrain from including a detailed game-theoretic derivation of this specification,¹⁸ but the intuition is straightforward. Competition between small firms drives down takeover prices to their outside options. These outside options depend on whether some competitor is taken over (in which case profits are $\Pi^S(Y_1^{t-1} + 1, F^{t-1} - 1)$) or not (in which case they are $\Pi^S(Y_1^t, F^{t-1})$). We sketch the case $\Pi^S(Y_1^{t-1} + 1, F^{t-1} - 1) \geq \Pi^S(Y_1^t, F^{t-1})$, i.e., positive acquisition externalities, in slightly more detail.

Suppose the large firm states a maximum price r that it is prepared to pay for a small firm. Suppose all small firms then simultaneously state a price at which they are prepared to be taken over, and the firm stating the lowest price ($\leq r$) is taken over. The large firm will set r as low as possible. Clearly, it must demand at least $\Pi^S(Y_1^t, F^{t-1})$ for any small firm

¹⁷Thus, in the Fudenberg, Tirole (1984) terminology he plays "Top Dog" in the former case, "Lean and Hungry" in the latter case. However, there is a potential counter-effect. Take, for instance, the case with overinvestment. Deviating from investment in period 1 leads to one more competitor in period 2 because of the entry-deterring nature of acquisitions and, thus, to lower product market profits for the large incumbent. Hence, incentives to overinvest arise. On the other hand, however, with one more competitor, the costs of a possible second period acquisition are lower, and this effect reduces the strategic incentive to overinvest.

¹⁸A full derivation of (1) as the outcome of a takeover game is available from the authors on request.

to be prepared to sell. If it sets $r = \Pi^S(Y_1^t, F^{t-1})$, there are chicken-type multiple equilibria, with one firm demanding a selling price of $\Pi^S(Y_1^t, F^{t-1})$ and the others demanding more: Because of positive acquisition externalities, small firms want a takeover to take place, but prefer others to be taken over. Thus, if one accepts the idea that small firms coordinate on one of the asymmetric equilibria, then $\Pi^S(Y_1^t, F^{t-1})$ is a natural acquisition cost.¹⁹

5.1 The Synergy Game

We specify the set-up of section 2 as follows. Firms compete in a homogenous-good industry. Inverse demand is given by $p = \alpha - \beta X$, where p is the price, X is the total quantity sold in the industry and α and β are demand parameters. Firm i has the cost function $C_i = x_i/Y_i^\gamma$, where x_i is the quantity produced by firm i and $\gamma > 0$ is a synergy parameter. Thus, the large incumbent has lower marginal costs than the small incumbents, whose marginal costs are normalized to 1. These synergies are, however, decreasing in the number of firms already acquired.

In this *synergy game*, calculation of equilibrium product market profits reveals the following properties. The equilibrium profits do not satisfy all of the sufficient conditions for monopolization in proposition 2 (a). As in the standard linear homogeneous Cournot model, acquisitions have positive externalities on small firms' profits even though we allow for synergies,²⁰ which, in addition, results in increasing acquisition costs. The large incumbent's acquisition incentives are still self-reinforcing in spite of declining synergies from mergers, mainly because of the market structure effect on the large firm's profits. Acquisition gains rise substantially through the elimination of a competitor when the firm number in the market becomes small. This property of the large firm's profit function dominates the declining synergies from mergers.

¹⁹An alternative view would be that mixed strategy equilibria are played, which would tend to increase the acquisition price.

²⁰This property is not general; acquisition externalities eventually become negative, for instance, as entry costs decrease substantially. With very low entry costs, potentially many small firms compete in the market and the positive effect of an acquisition through a decrease in the firm number virtually becomes negligible.

Insertion of the product market profits into proposition 1 and the analogous expressions for the alternative equilibria yields conditions for all conceivable equilibria. For $\alpha = 5, \beta = \gamma = 1$ and $E = 0.75$, Figure 1 describes the combinations of Y_1^{t-1} and F^{t-1} for which each type of equilibrium emerges in the static game. The lines in the figure correspond to the boundaries of the (no-)entry conditions $ENT1$ and the acquisition conditions $ACQ0$ from proposition 1.

< Figure 1 about here >

First, note that, by (A3), entry becomes harder when there are many firms in the market and/or when the large incumbent has a high state, that is, low marginal costs, which explains the declining line ENT_1 .

More interestingly, the acquisition condition is non-monotone in the number of small firms. To understand this, recall that an acquisition of a small incumbent by the large incumbent is more profitable the higher OSE and MSE and the lower AC . In general, changes in F^{t-1} do not influence OSE , MSE and AC in the same fashion. Concerning OSE , the cost reduction following a merger is independent of the number of other firms in the market. The effect that any given cost reduction has on profits usually is higher the lower the number of other firms in the market: with a lower number of competitors, the own output level will be higher, making cost-reductions more valuable. Thus, OSE should be decreasing in F^{t-1} . The same is true for MSE . Intuitively, positive price effects from eliminating competition are higher when the firm already has a high market share. Finally, acquisition costs fall as the number of small firms grows. To sum up, OSE , MSE and AC are all decreasing in the number of firms. The non-monotonicity in our example may thus be explained as follows. Starting from low firm numbers, the decreasing own state effect and the decreasing market structure effect dominate over decreasing acquisition costs, and mergers become less profitable as the firm number increases. As F^{t-1} increases further, the effect of decreasing acquisition costs eventually dominates over the market structure effect and the own state effect, so that acquisitions become more likely.

In Figure 1, an increase in Y_1^{t-1} unambiguously makes the acquisition condition harder to satisfy. This reflects decreasing synergies which reduce

OSE. However, there are also countervailing effects. First, any given cost reduction is more valuable the higher the market share. Second, decreasing acquisition costs also have to be taken into account. Therefore, for alternative specifications (for instance, non-decreasing synergies) the impact of Y_1^{t-1} on acquisition incentives may be reversed.

In this example, three pure strategy equilibria can arise: the strong concentration equilibrium $(1, 0)$, the weak concentration equilibrium $(1, 1)$, where both players of the game invest and the stationary equilibrium $(0, 0)$ where no player invests. Figure 1 also reveals that the myopic game displays differences in long-term behavior depending on the initial value of the large firm's size and the initial number of firms in the market. When there are not many small firms initially (as in point *A*), monopolization will eventually arise, since the system moves one unit down and one unit to the right whenever there is a strong concentration equilibrium. Thus, even though synergies are declining and acquisition costs are rising, this model is able to generate a pattern of myopic market dynamics where firm asymmetries become increasingly pronounced. When there are many small firms initially, however, (as in point *B*), the concentration process may come to a halt long before monopolization, as the system reaches the stationary equilibrium region where it remains forever. This result has interesting implications. It would for instance suggest that a newly privatized industry with a large incumbent and a small fringe may never develop towards a competitive market, whereas an otherwise identical industry may have a chance to retain a relatively competitive market structure when it starts out competitively.²¹

The effects of changes in other parameters are briefly summarized without figures. Consider the demand parameter α and the synergy parameter γ . Entry becomes less likely as α decreases and γ increases. Acquisition conditions are also easier to fulfill as γ increases. Less obviously, a decrease in α makes acquisitions more likely. This mainly reflects the effects of decreasing

²¹We should, however, be cautious in interpreting the myopic dynamics of the synergy game. The result of increasing dominance when starting at point *A* may be an artefact of the simplifying assumption that only one firm is able to carry out acquisition. Otherwise, countervailing effects may arise. The reason is that, with declining synergies, smaller firms should also have higher acquisition incentives than large firms, leading to a tendency towards declining asymmetries between firms (see section 6).

acquisition costs.

5.2 Merging for Variety

Often, firms use mergers and acquisitions to expand into related markets. Accordingly, we now interpret a firm's state variable as the number of product varieties it sells. Thus, each small firm sells one variety; a large firm sells Y_1^t varieties. $\Pi^L(Y_1^t, F^t)$ is the profit of a large firm that sells Y_1^t varieties when there are F^t small firms in the market. $\Pi^S(Y_1^t, F^t)$ is the profit of a small firm facing a large firm which sells Y_1^t varieties and $F^t - 1$ other small firms, each of which sells one variety. We introduce the additional notation $\pi^L(Y_1^t, V^t) = \Pi^L(Y_1^t, V^t - Y_1^t) / Y_1^t$ for the profit of a large firm per variety sold, when its state is Y_1^t and the total number of varieties is $V^t = Y_1^t + F^t$. We thus write $\pi^S(Y_1^t, V^t) = \Pi^S(Y_1^t, V^t - Y_1^t)$ for the profits of a small firm when V^t varieties are sold and the large competitor sells Y_1^t varieties.²²

Now consider the inverse demand function $p_l = a - bx_l - c \sum_{k \neq l} x_k$ with $a, b, c > 0$ and $b > c$. Firms compete in prices.²³ For the following illustration, we set $a = 5, b = 1, c = 0.75$ and $E = 0.15$. Figure 2 summarizes the equilibria. Note that the figure is only meaningful for $Y_1^{t-1} \leq V^{t-1}$, the region bounded below by the bold line. There are some important differences with respect to the synergy example.

< Figure 2 about here >

First, market entry becomes more likely as the large incumbent becomes larger. This reflects positive acquisition externalities: large firms price less aggressively to avoid cannibalizing demand on its other varieties. Second, the higher V^{t-1} and the lower Y_1^{t-1} , the larger the incentive for a firm to acquire

²²Implicit in this set-up is the symmetry assumption that each small firm earns the same profit and that the large firm earns the same profit for each variety.

²³For price competition, it would seem more natural to consider demand functions $x_l = A - B + C \sum_{k \neq l} p_k$ rather than inverse demand. However, this would for instance imply that the maximal demand per variety is independent of the number of varieties. Our demand system corresponds to a demand function $x_l = A(V) - B(V) + C(V) \sum_{k \neq l} p_k$ with $A' < 0, B' > 0, C' < 0$, which seems more plausible.

a small competitor in order to enlarge the range of varieties it produces.²⁴ To understand this, consider the effect of increasing Y_1^{t-1} . As Y_1^{t-1} increases, acquisition costs rise, which makes acquisitions less attractive. However, the additional variety becomes more valuable, as $\pi^L(Y_1^{t-1} + 1, V^{t-1})$ increases in Y_1^{t-1} . Furthermore, the profit increase per variety, $(\pi^L(Y_1^{t-1} + 1, V^{t-1}) - \pi^L(Y_1^{t-1}, V^{t-1}))$, is larger if the large firm already sells more varieties. The effect of increasing V^{t-1} reflects decreasing acquisition costs. However, there are also opposing effects. For instance, as V^{t-1} increases, $\pi^L(Y_1^{t-1} + 1, V^{t-1})$ falls, which makes acquisitions less attractive.

The resulting equilibrium behavior is much simpler than in the synergy example: Only the strong and the weak concentration equilibria are possible. Unsurprisingly, the strong concentration equilibrium is more likely when the total number of varieties is large and the size of the large firm relatively small, as entry becomes less attractive. More interestingly, acquisitions are worthwhile for arbitrary initial conditions. Thus, the positive effects from acquisitions are always greater than the acquisition costs, i.e., small firm profits. Intuitively, large firm acquisition benefits consist of the profits from selling one more variety, and the increased profits on the other varieties. The second effect introduces a wedge between small firm profits, that is, acquisition costs, and large firm acquisition benefits which is why acquisitions are so attractive in this context.

The resulting myopic dynamics are thus extremely simple. In the long run, the system always "moves to the north-east", that is, there is continuous entry with simultaneous acquisitions by the large firm.²⁵ Initial values matter only because, with a large initial number of small firms, there will be no entry until the large firm has reached a critical size. To sum up, merging for variety leads to increasing market concentration even though acquisition externalities are positive and, thus, acquisition costs are rising. However,

²⁴Note that the acquisition condition (ACQ1) always holds since the corresponding line lies below the bold line.

²⁵This result might appear to contradict Sutton's (1998) general result that markets with a certain degree of product differentiation reveal low concentration levels. However, in his model the firm number is fixed. Further, firms are not involved in acquisition and market entry decisions, respectively, but in the choice of quality levels for each of their varieties.

market monopolization never occurs because market entry becomes more and more valuable when the large firm grows steadily.

We briefly report the effects of two other parameters without giving figures. An increase in market size a makes entry more likely. Also, it turns out that market size increases leave the acquisition condition unaffected, so that the strong concentration equilibrium becomes less likely.²⁶ An increase in substitutability c decreases entry incentives and increases acquisition incentives, so the strong concentration equilibrium becomes more likely. Both observations are consistent with the notion that increasing intensity of competition, that is, lower small firm profits and thus lower acquisition costs, increases the chances for a strong concentration equilibrium.

5.3 Real World Examples

We briefly sketch how the four examples given in the introduction can be interpreted in the light of our framework. First, the beer industry nicely fits the merger for variety case: The vertically integrated breweries acquired others because this gave them the possibility to sell other product varieties, that is, beer in other local markets. Additionally, due to the limited number of beer sales licenses entry cost were very high, corresponding to low no-entry condition ENT_1 . The reported increase in concentration is thus what we should expect.

The stationary equilibrium in the corporate law case does not exactly fit either of the two examples. Within the more general model of sections 2 to 4, it still makes sense, however. Informal accounts of the industry suggest that the quality of services provided tends to suffer from excessive firm size (Economist, 2000). With quality as the state variable, own state effects are thus small or even negative. Combined with high entry costs, this results in a stationary equilibrium.

The PC example is also broadly consistent with the more general model. As the "clone"-terminology suggests, the issue of variety is not substantial in this case. The scope for cost-cutting or quality enhancement by acquisition

²⁶This is a result of the linear specification.

also appears to be limited. On the other hand, high demand and low entry costs make entry attractive.²⁷

Trying to explain the airline example clearly shows some limitations of our approach. Though much of the real world story seems to be about product variety, asymmetries between varieties play an essential role, contrary to our assumptions. The simultaneous entry and acquisition in this industry relies on the simultaneous existence of high and low quality services. New firms enter, offering cheap low-quality services, whereas acquisitions concern only higher quality services. Apparently this pattern can obtain because the large airlines cannot simply copy the low-cost technology of the entrants, because such a behavior would have adverse effects on their other lines (because of reputational effects for instance). Market dynamics are thus driven by vertical quality differences that are not accounted for by our model. The software and toy industry broadly fit our variety model: According to Pesendorfer (2002), there is a continuous flow of entrants which are often rapidly bought up by the market leaders. The equilibrium is thus of the (1,1) type.

6 The Multi-Player Investment Game

We now allow more than one firm to take over small firms and more than one firm to enter. More precisely, we replace (A5) with the following assumption.

(A5)' *At the beginning of each period t , the set of all firms is divided into $A^{t-1} \geq 1$ acquirors of size ≥ 1 , $B^{t-1} \geq 1$ potential entrants and S^{t-1} small firms that are not allowed to invest.*

Apart from dispensing with the restriction $A^{t-1} = B^{t-1} = 1$, we thus also allow some small firms to acquire other small firms. One unsatisfactory feature of (A5) that carries over to (A5)' is the artificial division between potential investors and potential acquirees. Without this distinction, the model would become extremely complex. Even in our simplified setting, an exact calculation of different equilibria for arbitrary parameter values is

²⁷The fact that some entrants, such as Dell, provided additional innovations enhanced the process, but is not strictly speaking necessary.

cumbersome. However, at least for the myopic case, we can sidestep such problems by applying theorem 1 in Athey and Schmutzler (2001) to give sufficient conditions under which large firms always invest at least as much as small firms in equilibrium.

To apply this result, it is convenient to write net equilibrium payoffs (profits minus investment costs) in the oligopoly game at the end of period t as a function \mathbf{Y}^{t-1} and \mathbf{a}^t rather than as a function of \mathbf{Y}^t and \mathbf{F}^t . Suppose w.l.o.g. that active firms in period t are ordered so that the first $I^{t-1} = A^{t-1} + B^{t-1}$ firms are potential investors, and firms $I^{t-1} + 1, \dots, N^{t-1}$ are non-investors. Let $Z_i^{t-1} \equiv Y_i^{t-1}$ for all $i \in 1, \dots, I^{t-1}$. Let $\mathbf{Z}^{t-1} = (\mathbf{Z}_1^{t-1}, \dots, \mathbf{Z}_{I^{t-1}}^{t-1})$ be the vector of states of all potential investors. Let $\mathbf{a}^t \equiv (a_1^t, \dots, a_{I^{t-1}}^t)$ be the vector of investment decisions. Define $n_A(\mathbf{Z}^{t-1}, \mathbf{a}^t)$ as the number of acquisitions in period t and $n_E(\mathbf{Z}^{t-1}, \mathbf{a}^t)$ as the number of entrants. By (A1) and (A2), product market profits for any investor i are fully determined by $\mathbf{Z}^t = \mathbf{Z}^{t-1} + \mathbf{a}^t$ and $S^t(\mathbf{Z}^{t-1}, \mathbf{a}^t, \mathbf{S}^{t-1}) = \mathbf{S}^{t-1} - n_A(\mathbf{Z}^{t-1}, \mathbf{a}^t) + n_E(\mathbf{Z}^{t-1}, \mathbf{a}^t)$. Thus write $\hat{\Pi}^i(\mathbf{Z}^t, S^t(\mathbf{Z}^{t-1}, \mathbf{a}^t, \mathbf{S}^{t-1}))$ for firm i 's product market profits. Similarly, we write $AC(\mathbf{Z}^{t-1} + \mathbf{a}^t, \mathbf{S}^{t-1})$ for acquisition costs. We introduce the following variant of (A6).

(A6)' AC is decreasing in \mathbf{Z}^t and \mathbf{S}^t .

Define

$$k^i(\mathbf{Z}^{t-1}, \mathbf{a}^t, \mathbf{S}^{t-1}) = \begin{cases} E, & \text{if } Z_i^{t-1} = 0 \\ AC(\mathbf{Z}^{t-1} + \mathbf{a}^t, S^t(\mathbf{Z}^{t-1}, \mathbf{a}^t, \mathbf{S}^{t-1})), & \text{if } Z_i^{t-1} > 0 \end{cases}.$$

Then net profits can be written as

$$\pi^i(\mathbf{Z}^{t-1}, \mathbf{a}^t, \mathbf{S}^{t-1}) = \hat{\Pi}^i(\mathbf{Z}^{t-1} + \mathbf{a}^t, S^t(\mathbf{Z}^{t-1}, \mathbf{a}^t, \mathbf{S}^{t-1})) - k^i(\mathbf{Z}^{t-1}, \mathbf{a}^t, \mathbf{S}^{t-1}).$$

Our goal is to give conditions such that, for any given \mathbf{S}^{t-1} , $Z_k^{t-1} \geq Z_l^{t-1}$ implies $a_k^t \geq a_l^t$. To see this, consider the following condition.

Definition 3 *Product market profits satisfy markup-demand complementarity (MDC) if $\hat{\Pi}_{Z_i Z_i}^i > 0$; $\hat{\Pi}_{Z_i S}^i < 0$; $\hat{\Pi}_{SS}^i > 0$; $\hat{\Pi}_{Z_i Z_j}^i < 0$; $\hat{\Pi}_{Z_j S}^i > 0$.*

To simplify language, when we speak of negative (positive) acquisition externalities we shall take this to also include that acquisition costs are decreasing (increasing). We obtain the following result.

Proposition 5 *Suppose (A1)–(A4), (A5)', (A6)' and (MDC) hold. Suppose further that*

- (1) $\frac{\partial \hat{\Pi}^i}{\partial Z_i}$ and $|\frac{\partial \hat{\Pi}^i}{\partial S}|$ are sufficiently large for $Z_i \geq 1$.
- (2) $\hat{\Pi}^i$ is small for $Z_i = 1$; Acquisition costs are small.
- (3) Acquisition externalities are non-positive, but not very negative.

Then $Z_k \geq Z_l$ implies $a_k \geq a_l$.

Proposition 5 gives a set of sufficient conditions for (weakly) increasing concentration in a set-up with multiple investors. Conditions (1) and (2) essentially restate the idea from section 3 that, with a large *OSE*, *MSE* and with tough competition, acquisitions are more likely to take place than entry. Condition (MDC) and (3) make sure that the larger a firm, the more likely it is to acquire small firms. Condition (MDC) is satisfied in many oligopoly models, condition (3) only holds in intermediate parameter regimes.

Proposition 5 uses theorem 1 in Athey and Schmutzler (2001), which implies the following result in our setting:

Lemma 2 *Suppose (A1) – (A4), (A5)' and (A6)' hold. Suppose further*

- (i) π^i has increasing differences in (Z_i^{t-1}, a_i^t) .²⁸
- (ii) π^i has decreasing differences in (Z_j^{t-1}, a_i^t) for $j \neq i$.
- (iii) The players' actions are strategic substitutes in π^i .

Then $Z_k^{t-1} \geq Z_l^{t-1}$ implies $a_k^{t-1} \geq a_l^{t-1}$.

The intuition for this lemma is straightforward for two active firms. The direct effect of having a high state on a firm is having a high return on investment by (i). The direct effect on the competitor is that he has a low return by (ii). By (iii), these effects reinforce each other.

In Appendix E, we prove proposition 5 by showing that the conditions of the theorem imply the three conditions of the lemma. The proof also

²⁸ That is, $\pi^i(Z_i^{t-1}, 1, \mathbf{S}^{t-1}) - \pi^i(Z_i^{t-1}, 0, \mathbf{S}^{t-1})$ is increasing in Z_i^{t-1} .

clarifies the precise meaning of "sufficiently large" and "small" in conditions (1) and (2) of the proposition 5. To see that the three conditions hold, we need to consider several cases, depending on whether the investment is entry or an acquisition. In the terminology of section 3, (i) requires that NIE is increasing in the state of the investor. In particular, to show that NIE is at least as big as for $Z_i^{t-1} > 0$ than for $Z_i^{t-1} = 0$, we need to show that $NAE \geq NEE$. Conditions (1) and (2) of the theorem guarantee this result. To show that NIE is increasing in Z_i^{t-1} for $Z_i^{t-1} \geq 1$, we need to make sure that NAE increases with the own state. (MDC) is helpful to obtain this, as it implies that, after an increase in the own state, both the benefit from a further increase in the state and from the elimination of a competitor are higher. The result then follows as AC is decreasing in the own state.

(ii) requires that NIE is decreasing in Z_j^{t-1} . For NEE , that is, for $Z_i^{t-1} = 0$ this follows trivially from (A3). For NAE , $\hat{\Pi}_{Z_i Z_j}^i < 0$ and $\hat{\Pi}_{S Z_j}^i > 0$ make sure that product market profits from an acquisition increase more when facing a competitor with a low-state Z_j . Given negative acquisition externalities, however, acquisition costs are higher with a low-state competitor, as small firms' product market profits are. Thus, a countervailing force to increasing concentration might arise. If acquisition externalities are sufficiently low, however, this effect is dominated.

(iii) requires that NIE decreases if a competitor invests. It consists of four subconditions, depending on whether the investment variables of each of the two firms considered correspond to entry or acquisition. It follows from negative acquisition externalities if a_i is entry and a_j is an acquisition. If a_i and a_j are entry variables, strategic substitutability follows by (A3). If a_i is an acquisition, one has to resort to (MDC) : $\hat{\Pi}_{Z_i Z_j}^i < 0, \hat{\Pi}_{Z_i S}^i < 0, \hat{\Pi}_{Z_j S}^i > 0$ and $\hat{\Pi}_{S S}^i > 0$ imply that the profit increase from an acquisition is higher when some potential entrant does not enter. Again, unless acquisition costs are sufficiently small, they may yield a countervailing effect, as they are lower when entry takes place. To make sure that an acquisition is more valuable when some competitor does not carry out an acquisition, similar arguments are required.

We do not explicitly consider forward-looking firms in this section. Intuitively, it is clear that strategic considerations would arise that are not

present in section 4.2. Large firms would not only consider the strategic effects of their acquisition decisions on future entry, but also on competitors' acquisition decisions. If acquisitions by competitors are desired, the strategic incentive would depend on whether acquisitions make future acquisitions by competitors more likely, and correspondingly, if acquisitions are not desired.²⁹

7 Conclusions and Extensions

This paper has used an extremely simple framework to discuss under which circumstances concentration increases in a market with entry and acquisitions. The first set of results was developed in a static model: stated succinctly, these results show that increasing concentration is more likely for tough competition.

The next set of results concerns myopic dynamics. We provided a set of sufficient conditions for increasing concentration to increase the likelihood of future concentration: self-reinforcing acquisition incentives, negative acquisition externalities and decreasing acquisition costs. While self-reinforcing acquisition incentives often hold, the latter two conditions are less likely, as they require fairly strong synergies. When synergies are not strong, concentration processes often come to a halt before monopolization.

With forward-looking firms, the conditions favoring concentration in a static world are also relevant, but require modification. Strategic incentives reinforce concentration tendencies when acquisition externalities are negative and reduce them when they are positive.

For a linear Cournot model where mergers result in cost-reducing synergies, we show that a smaller market, a higher synergy parameter and higher entry costs increase concentration. The number of small firms usually and the initial size of the large firm generally have ambiguous effects, depending on the specification of synergies. Myopic dynamics are fairly complex as a result - with the chances of monopolization depending on initial conditions.

An example of price competition with mergers as expansions into related

²⁹Nilssen and Sørsgard (1999) consider related issues in a simple model with mergers, but without entry.

markets differs strongly in that it has a built-in force towards concentration. Acquisitions have the positive effect that the acquiring firm can increase prices on the acquired variety so as to increase profits on its old product varieties. While the price increases generate positive acquisition externalities, acquisition incentives are so strong that acquisitions always arise in equilibrium. Myopic dynamics thus also imply increasing concentration.

One possible extension of the paper concerns internal investments. What would happen if cost-reductions or expansions in the product spectrum could also be achieved by internal investments? Would the same factors foster concentration? In addition, the analysis should be supplemented by managerial considerations. There are many empirical studies about the effects of mergers on the profits of the firms involved. While no consensus has emerged so far, acquisitions are certainly not seen to be profit-increasing in general.³⁰ Though there is no obvious reason why the qualitative insights of this paper should not survive as long as managerial utility is at least positively correlated with firm profits, this should be checked.

³⁰For conflicting views on this subject, see Ravenscraft and Scherer (1989) and Healy et al. (1992).

Appendices

A Proof of Lemma 1

Using $\Pi_{Y_1 Y_1}^L \geq 0, \Pi_{Y_1 F}^L \leq 0, \Pi_{FF}^L \geq 0$,

$$\begin{aligned}
& \Pi^L(Y_1^{t-1} + 1, F^{t-1} - 1) - \Pi^L(Y_1^{t-1}, F^{t-1}) = \\
& \Pi^L(Y_1^{t-1} + 1, F^{t-1} - 1) - \Pi^L(Y_1^{t-1}, F^{t-1} - 1) \\
& + \Pi^L(Y_1^{t-1}, F^{t-1} - 1) - \Pi^L(Y_1^{t-1}, F^{t-1}) = \\
& \int_{Y_1^{t-1}}^{Y_1^{t-1}+1} \Pi_{Y_1}^L(Y_1, F^{t-1} - 1) dY_1 - \int_{F^{t-1}-1}^{F^{t-1}} \Pi_F^L(Y_1^{t-1}, F) dF \geq \\
& \int_{Y_1^{t-1}}^{Y_1^{t-1}+1} \Pi_{Y_1}^L(Y_1^{t-1} - 1, F^{t-1} - 1) dY_1 - \int_{F^{t-1}-1}^{F^{t-1}} \Pi_F^L(Y_1^{t-1}, F) dF = \\
& \int_{Y_1^{t-1}-1}^{Y_1^{t-1}} \Pi_{Y_1}^L(Y_1, F^{t-1} - 1) dY_1 - \int_{F^{t-1}-1}^{F^{t-1}} \Pi_F^L(Y_1^{t-1}, F) dF \geq \\
& \int_{Y_1^{t-1}-1}^{Y_1^{t-1}} \Pi_{Y_1}^L(Y_1, F^{t-1}) dY_1 - \int_{F^{t-1}}^{F^{t-1}+1} \Pi_F^L(Y_1^{t-1} - 1, F) dF = \\
& \Pi^L(Y_1^{t-1}, F^{t-1}) - \Pi^L(Y_1^{t-1} - 1, F^{t-1}) \\
& + \Pi^L(Y_1^{t-1} - 1, F^{t-1}) - \Pi^L(Y_1^{t-1} - 1, F^{t-1} + 1) = \\
& \Pi^L(Y_1^{t-1}, F^{t-1}) - \Pi^L(Y_1^{t-1} - 1, F^{t-1} + 1).
\end{aligned}$$

B Proof of Proposition 2

If there is a strong concentration equilibrium in any period and there are negative acquisition externalities, small firm profits are smaller in the next period, so that $(ENT1)$ in period $t - 1$ implies $(ENT1)$ in period t , and similarly for $(ENT0)$. Also, as acquisition costs are decreasing and acquisition incentives increasing, if $(ACQ0)$ holds at the end of period $t - 1$ and $(1, 0)$ is played during period t , $(ACQ0)$ holds at the end of period t .

C Proof of Proposition 3

By assumption, every second-period subgame has a strong concentration equilibrium. Therefore, the first-period payoff matrix is as described in Table 2.

< Table 2 about here >

Since $(ACQ0)$ holds in any second period subgame

$$\Pi^L(Y_1^0 + 1, F^0 - 1) - \Pi^L(Y_1^0, F^0) \geq AC(Y_1^0 + 1, F^0 - 1)$$

and

$$\Pi^L(Y_1^0 + 2, F^0 - 2) - \Pi^L(Y_1^0 + 1, F^0 - 1) \geq AC(Y_1^0 + 2, F^0 - 2).$$

Summing up these inequalities, we have

$$\begin{aligned} \Pi^L(Y_1^0 + 2, F^0 - 2) - \Pi^L(Y_1^0, F^0) \\ - AC(Y_1^0 + 1, F^0 - 1) - AC(Y_1^0 + 2, F^0 - 2) \geq 0. \end{aligned}$$

$AC_0 \leq 2AC(Y_1^0 + 1, F^0 - 1)$ implies

$$\begin{aligned} \Pi^L(Y_1^0 + 2, F^0 - 2) - \Pi^L(Y_1^0, F^0) - AC_0 - AC(Y_1^0 + 2, F^0 - 2) + \\ AC(Y_1^0 + 1, F^0 - 1) \geq 0. \end{aligned}$$

Thus, it is not profitable for firm 1 to deviate from the equilibrium strategy. For firm e_0 , deviations are not profitable by assumption.

D Proof of Proposition 4

We proceed as in the proof of proposition 3. By entry-deterrence and by the assumption that $a_1^2 = 1$, the weak concentration equilibrium (1,1) is played in subgames (00) and (01), and the strong concentration equilibrium (1,0) is played in subgames (10) and (11). The large firm's total equilibrium payoff when investing in period 1 (and entry is absent) is $\Pi^L(Y_1^0 + 1, F^0 - 1) +$

$\Pi^L(Y_1^0 + 2, F^0 - 2) - AC_0 - AC(Y_1^0 + 2, F^0 - 2)$. Deviating to non-investment in period 1 would provoke second-period entry and yield payoffs $\Pi^L(Y^0, F^0) + \Pi^L(Y^0 + 1, F^0) - AC(Y_1^0 + 1, F^0)$. After suitable additions of zero, the difference can thus be written as

$$\begin{aligned} & \Pi^L(Y_1^0 + 2, F^0 - 2) - \Pi^L(Y_1^0 + 1, F^0 - 1) - AC(Y_1^0 + 2, F^0 - 2) \\ & + AC(Y_1^0 + 1, F^0 - 1) + \Pi^L(Y_1^0 + 1, F^0 - 1) - \Pi^L(Y_1^0, F^0) - AC_0 \\ & + \Pi^L(Y_1^0 + 1, F^0 - 1) - \Pi^L(Y_1^0 + 1, F^0) + AC(Y_1^0 + 1, F^0) - AC(Y_1^0 + 1, F^0 - 1), \end{aligned}$$

where the first two lines describe the direct acquisition effect on the large firm's profit in period 2 and 1, and the third line describe the strategic effect. By assumption (A3) the difference between the product market profits in the last line are positive, the difference between the acquisition costs are negative.

E Proof of Proposition 5

We show that the conditions in lemma 2 hold if the conditions in the theorem do. We address each condition in turn. For simplicity of notation, we shall only consider investing firms with indices 1 and 2.

- (i) π^1 has increasing differences in (Z_1^{t-1}, a_1^t) .

We have to distinguish between acquisition (ia) and entry (ib) decisions.

- (ia) Acquisitions are more profitable for firm i the higher its size:

$$\begin{aligned} & \hat{\Pi}^1[(Z_1^{t-1} + 1, Z_2^t), S^{t-1} - 1] - \hat{\Pi}^1[(Z_1^{t-1}, Z_2^t), S^{t-1}] - \\ & AC[(Z_1^{t-1} + 1, Z_2^t), S^{t-1} - 1] \geq \hat{\Pi}^1[(Z_1^{t-1}, Z_2^t), S^{t-1} - 1] - \\ & \hat{\Pi}^1[(Z_1^{t-1} - 1, Z_2^t), S^{t-1}] - AC[(Z_1^{t-1}, Z_2^t), S^{t-1} - 1]. \end{aligned}$$

This follows from $\hat{\Pi}_{Z_1 Z_1}^1 > 0$, $\hat{\Pi}_{Z_1 S}^1 < 0$ and the fact that AC is decreasing in Z_1 .

- (ib) Acquisitions are more profitable than entry: By condition (1) and (2) of the theorem,

$$\begin{aligned} & \hat{\Pi}^1[(Z_1^{t-1} + 1, Z_2^t), S^{t-1} - 1] - \hat{\Pi}^1[(Z_1^{t-1}, Z_2^t), S^{t-1}] \\ & - AC[(Z_1^{t-1} + 1, Z_2^t), S^{t-1} - 1] \geq \hat{\Pi}^1[(1, Z_2^t), S^{t-1} + 1] - E. \end{aligned}$$

- (ii) π^1 has decreasing differences in (Z_2^t, a_1^t) .
- (iia) Entry is more valuable if some other investor has a lower state.
 $\widehat{\Pi}^1[(1, Z_2^t), S^{t-1} + 1]$ is decreasing in Z_2^t . This follows immediately from (A3).
- (iib) If a_1^t corresponds to an acquisition, (ii) corresponds to the requirement that
 $\widehat{\Pi}^1[(Z_1^{t-1} + 1, Z_2^t), S^t - 1] - \widehat{\Pi}^1[(Z_1^{t-1}, Z_2^t), S^t] - AC[(Z_1^{t-1} + 1, Z_2^t), S^t - 1]$
 be decreasing in Z_2^t . For sufficiently low acquisition externalities, the result follows from $\Pi_{Z_i Z_j}^1 < 0$; $\Pi_{Z_j S}^1 > 0$.
- (iii) *Actions are strategic substitutes.*
 This condition requires that $\pi^1(\mathbf{Z}^{t-1}, (1, a_2^t), S^{t-1}) - \pi^1(\mathbf{Z}^{t-1}, (0, a_2^t), S^{t-1})$
 is weakly decreasing in a_2^t . Depending on whether Z_1^{t-1} and Z_2^{t-1} are positive or zero, that is, whether a_1^t and a_2^t correspond to an acquisition or an entry decision, (iii) thus has four sub-conditions.
- (iiia) Entry of firm 1 must be more profitable if firm 2 does not enter, i.e.,
 $\widehat{\Pi}^1((1, 0), S^t) \geq \widehat{\Pi}^1((1, 1), S^t + 1)$. This condition follows trivially from (A3).
- (iiib) Entry of firm 1 is more profitable if firm 2 does not acquire some competitor. Thus, $\widehat{\Pi}^1[(1, Z_2^{t-1}), S^t] \geq \widehat{\Pi}^1[(1, Z_2^{t-1} + 1), S^t - 1]$ for $Z_1^{t-1} \geq 1$. This condition clearly holds if there are non-positive acquisition externalities.
- (iiic) An acquisition by firm 1 is more valuable when firm 2 does not enter.
 $\widehat{\Pi}^1[(Z_1^{t-1} + 1, 0), S^t - 1] - \widehat{\Pi}^1[(Z_1^{t-1}, 0), S^t] - AC[(Z_1^{t-1} + 1, 0), S^t - 1] \geq$
 $\widehat{\Pi}^1[(Z_1^{t-1} + 1, 1), S^t] - \widehat{\Pi}^1[(Z_1^{t-1}, 1), S^t + 1] - AC[(Z_1^{t-1} + 1, 1), S^t]$.
 By (2) in theorem 5, it suffices to show that
 $\widehat{\Pi}^1[(Z_1^{t-1} + 1, 0), S^t - 1] - \widehat{\Pi}^1[(Z_1^{t-1}, 0), S^t - 1] + \widehat{\Pi}^1[(Z_1^{t-1}, 0), S^{t-1} - 1] -$
 $\widehat{\Pi}^1[(Z_1^{t-1}, 0), S^t] \geq \widehat{\Pi}^1[(Z_1^{t-1} + 1, 1), S^t] - \widehat{\Pi}^1[(Z_1^{t-1}, 1), S^t] +$
 $\widehat{\Pi}^1[(Z_1^{t-1}, 1), S^{t-1}] - \widehat{\Pi}^1[(Z_1^{t-1}, 1), S^t + 1]$.
 This follows from $\widehat{\Pi}_{Z_1 Z_2}^1 < 0$; $\widehat{\Pi}_{Z_1 S}^1 < 0$; $\widehat{\Pi}_{Z_2 S}^1 > 0$; $\widehat{\Pi}_{SS}^1 > 0$.
- (iiid) An acquisition by firm 1 is more valuable when firm 2 does not carry out an acquisition than when it does: $\widehat{\Pi}^1[(Z_1^{t-1} + 1, Z_2^{t-1}), S^t - 1] -$

$\widehat{\Pi}^1 \left[(Z_1^{t-1}, Z_2^{t-1}), S^t \right] - AC \left[(Z_1^{t-1} + 1, Z_2^{t-1}), S^t - 1 \right] \geq$
 $\widehat{\Pi}^1 \left[(Z_1^{t-1} + 1, Z_2^{t-1} + 1), S^t - 2 \right] - \widehat{\Pi}^1 \left[(Z_1^{t-1}, Z_2^{t-1} + 1), S^t - 1 \right] -$
 $AC \left[(Z_1^{t-1} + 1, Z_2^{t-1} + 1), S^t - 2 \right]$. This follows as in (iiic), using (4)
 in the theorem and $\widehat{\Pi}_{Z_1 Z_2}^1 < 0$; $\widehat{\Pi}_{Z_1 S}^1 < 0$; $\widehat{\Pi}_{Z_2 S}^1 > 0$; $\widehat{\Pi}_{SS}^1 > 0$.

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		Entrant \longrightarrow	
\downarrow Incumbent		$a_{e_t}^t = 0$	$a_{e_t}^t = 1$
$a_1^t = 0$	$\Pi^L(Y_1^{t-1}, F^{t-1}), 0$	$\Pi^L(Y_1^{t-1}, F^{t-1} + 1),$ $\Pi^S(Y_1^{t-1}, F^{t-1} + 1) - E$	
$a_1^t = 1$	$\Pi^L(Y_1^{t-1} + 1, F^{t-1} - 1) -$ $AC(Y_1^{t-1} + 1, F^{t-1} - 1), 0$	$\Pi^L(Y_1^{t-1} + 1, F^{t-1}) -$ $AC(Y_1^{t-1} + 1, F^{t-1}),$ $\Pi^S(Y_1^{t-1} + 1, F^{t-1}) - E$	

Table 1: The Payoff-Matrix for the One-Shot Game

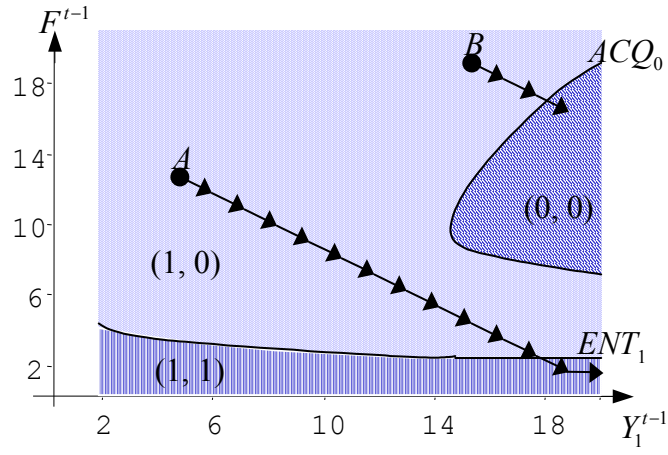


Figure 1: Pure Strategy Equilibria in the Static Synergy Game

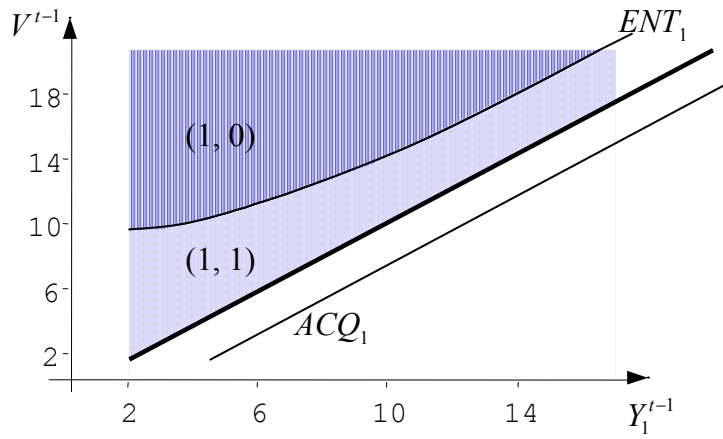


Figure 2: Pure Strategy Equilibria in the Merger for Variety Game

Entrant1 \longrightarrow

$a_{e_0}^0 = 0$ $a_{e_0}^0 = 1$

↓ Incumbent

$a_1^0 = 0$	$\Pi^L(Y_1^0, F^0)$ $+ \Pi^L(Y_1^0 + 1, F^0 - 1)$ $- AC(Y_1^0 + 1, F^0 - 1), 0$	$\Pi^L(Y_1^0, F^0 + 1)$ $+ \Pi^L(Y_1^0 + 1, F^0)$ $- AC(Y_1^0 + 1, F^0),$ $\Pi^S(Y_1^0, F^0 + 1) - E$ $+ \Pi^S(Y_1^0 + 1, F^0)$
$a_1^0 = 1$	$\Pi^L(Y_1^0 + 1, F^0 - 1) - AC_0$ $+ \Pi^L(Y_1^0 + 2, F^0 - 2)$ $- AC(Y_1^0 + 2, F^0 - 2), 0$	$\Pi^L(Y_1^0 + 1, F^0) - AC_1 +$ $\Pi^L(Y_1^0 + 2, F^0 - 1)$ $- AC(Y_1^0 + 2, F^0 - 1),$ $\Pi^S(Y_1^0 + 1, F^0) - E$ $+ \Pi^S(Y_1^0 + 2, F^0 - 1)$

Table 2: The First-Period Payoff Matrix

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